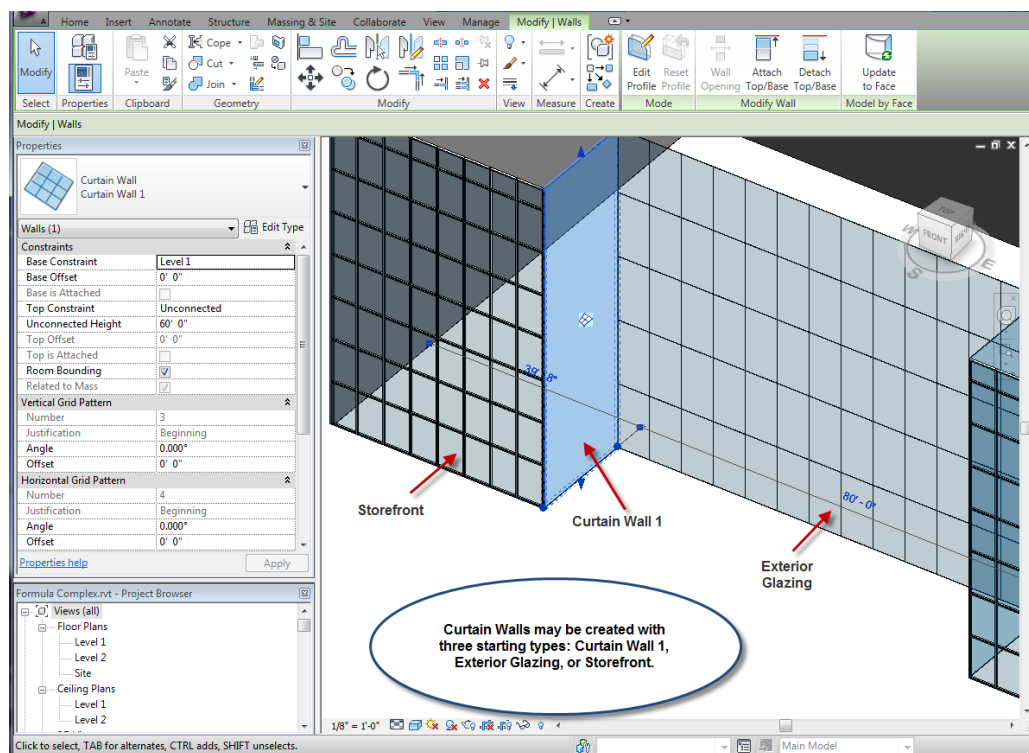


AGENDA:

1. Creating Typical Curtain Walls
2. Working with Curtain Grids and Layouts

1. Curtain Walls

Revit allows you to design Curtain Walls for use in the development of building facades using standard wall creation methods as well as by picking faces on conceptual masses. Curtain walls can be as simple or as complex as required.

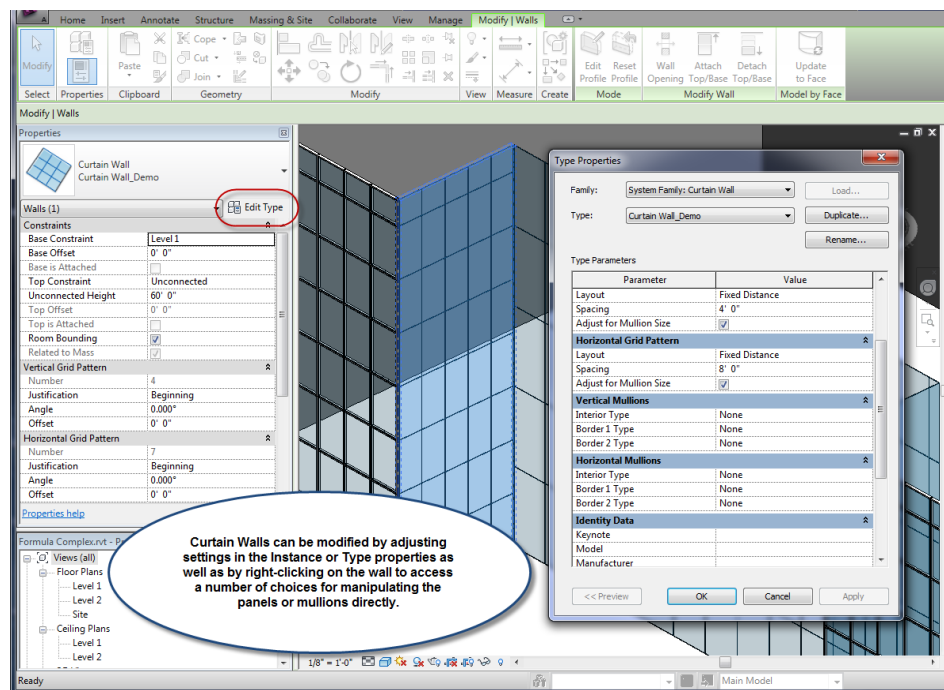


Curtain Walls come in 3 predefined types with varying levels of complexity. These three types can be modified and enhanced to accommodate a wide variety of styles. The Curtain Wall 1 type is the simplest and most flexible. It has no grids, no mullions, and no rules associated with it.

The Exterior Glazing type has preset grids based on grid rules which can be modified. The Storefront type is similar to Exterior Glazing but it also includes preset mullions as well as grids.

A Curtain Wall is any exterior wall that is attached to the building structure but which does not carry any structural loads from the floors or roof. Typically, a curtain wall is constructed with aluminum framing and infill panels of glass, metal panels, or thin stone panels. The Basic Curtain Wall 1 type is initially created as a single panel extending the length of the wall.

When you create a curtain wall you can use Grid lines and layout divisions to specify where mullions will be placed. Mullions are the structural elements which divide adjacent window units. Curtain walls may be modified with instance properties, type properties, or by selecting the curtain wall and then right-clicking on it to access a short cut menu.

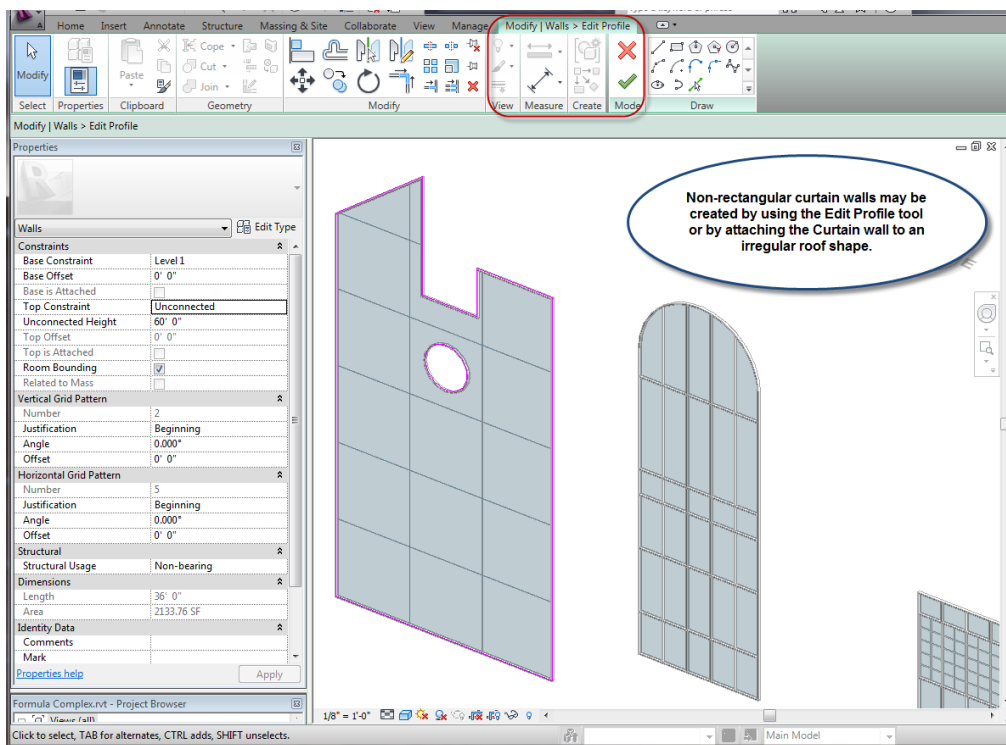


To create a Linear Curtain wall, select the Wall tool on the Build panel and in the type selector choose a curtain wall type and then either draw segments, pick edges, or pick faces. If you would like to define your initial grid properties, before you add the wall, specify justification, offsets, pattern angles, and constraints in the instance properties.

To change the Layout type, open the Edit Type dialog where you can specify the automatic grid settings for the Horizontal and Vertical grids. Mullion assignments and construction parameters are also available in the Type properties.

Non-Rectangular curtain walls are created by using the Edit Profile tool in the same way you can edit the shape of a rectangular wall. You can add holes by nesting shapes inside the outer loop. If you attach the top or base of the curtain wall you can also constrain the shape to adjacent irregular shaped elements.

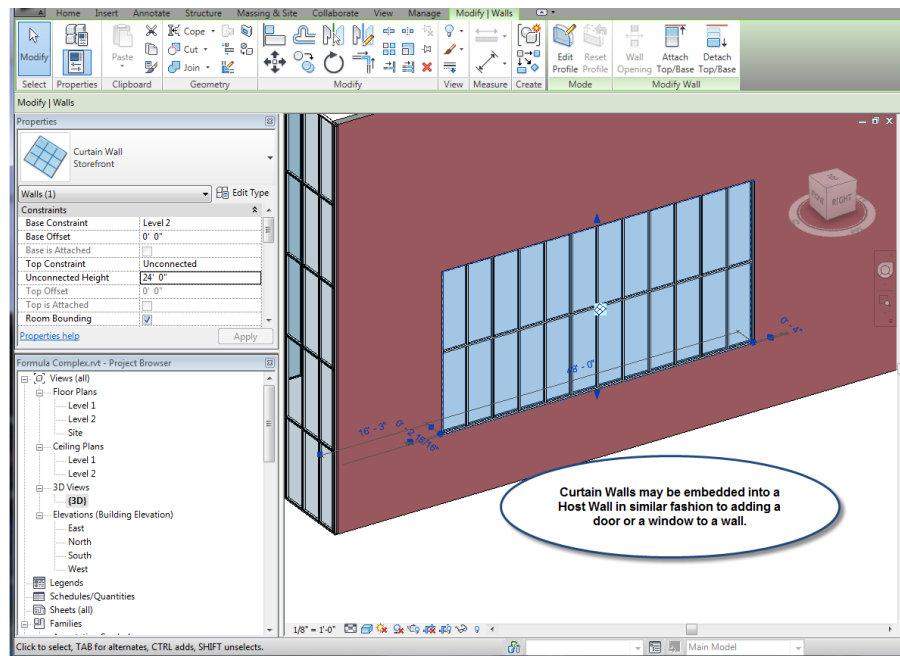
You can also create a non-linear curtain wall by picking an irregular shaped face on a mass although there are restrictions on how complex the form can be. For double-curved faces, you would need to generate a Curtain System instead of using a curtain wall.



Curtain Walls have several Construction parameters including Function, Embed, Curtain Panel and Join Condition. The function will default to Exterior, but can be set to Interior. Other functions such as Foundation, Retaining Wall and Core Shaft are also available but are not really applicable to a Curtain wall.

Linear Curtain walls can only use Curtain Wall panels with the System panels. Custom panels such as those created with the Curtain Panel by Pattern template may not be assigned as the default panel for a regular curtain wall.

The Automatically Embed construction parameter allows you to add a curtain wall to a host wall in a similar fashion to adding a door or a window. The embedded curtain wall will move and rotate with the host wall but will not resize if the host is resized.



By default, the Automatically Embed function is enabled for the Storefront and Exterior Glazing types but disabled for the Curtain Wall 1 type. It is still possible to use the Cut Geometry tool to manually embed a curtain wall into a Basic wall type.

You can modify curtain wall profile after it has been embedded and the host wall will automatically update to fill the areas around the modified profile. The curtain wall can be positioned at any location within the width of its host wall.

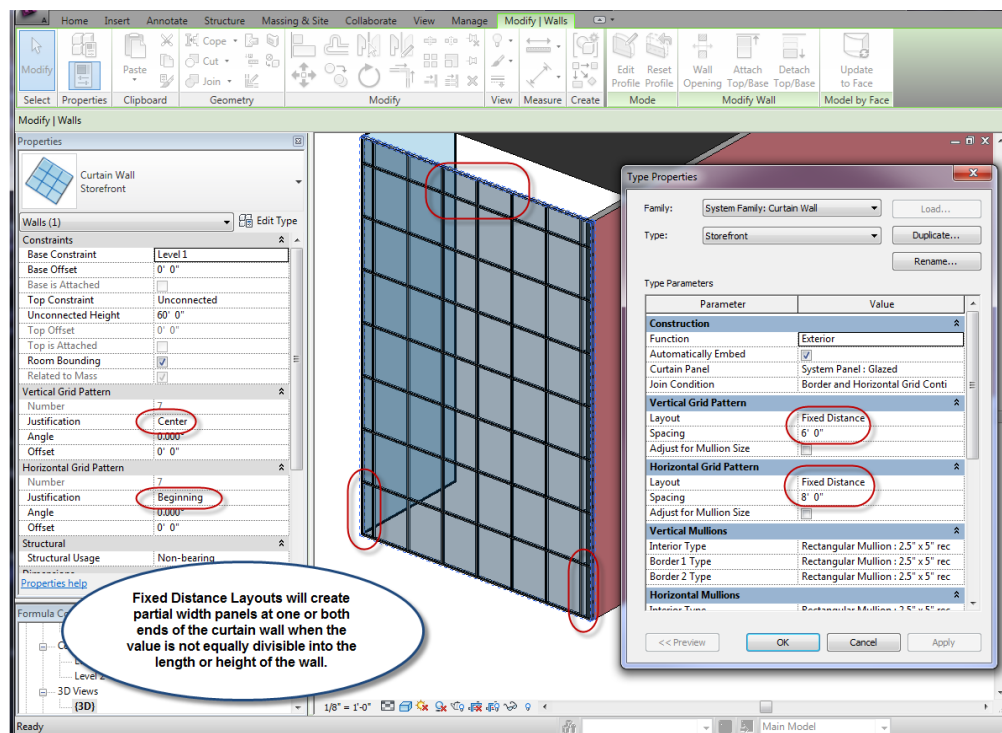
It is possible to use a Basic Wall type inside a Curtain wall panel and then embed the curtain wall inside another curtain wall or inside another basic wall. This process of nesting basic walls inside curtain panels and then embedding the curtain walls into other walls can be repeated as many times as desired.

By default all curtain walls will be justified along their center line but panels can be positioned on one side or the other. You can reverse the orientation of a curtain wall from the right click menu or by choosing the Flip grips which appear when a curtain wall is selected in a plan view.

2. Working with Layout Grids and Grid lines

You can preset a curtain element layout for curtain walls automatically by using the Type Driven layout settings. This allows you to create many instances of a curtain wall that already have panels, grids, and mullions assigned in a preset pattern.

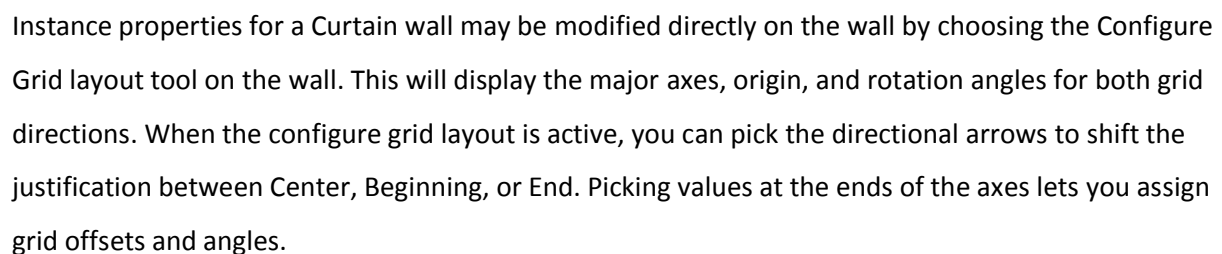
Type properties for the Layout grid let you specify the locations of grid lines along the Horizontal and Vertical directions of the grid. Available options include Fixed Distance, Fixed Number, Maximum Spacing and Minimum Spacing. These work in a similar fashion to the way they do when Dividing a Surface in the Conceptual Design Environment.



Fixed distance sets the exact width or height of a panel and if this distance is not equally divisible along the length or height of the wall, one or two smaller panels will be added at one or both ends depending on the Justification instance property.

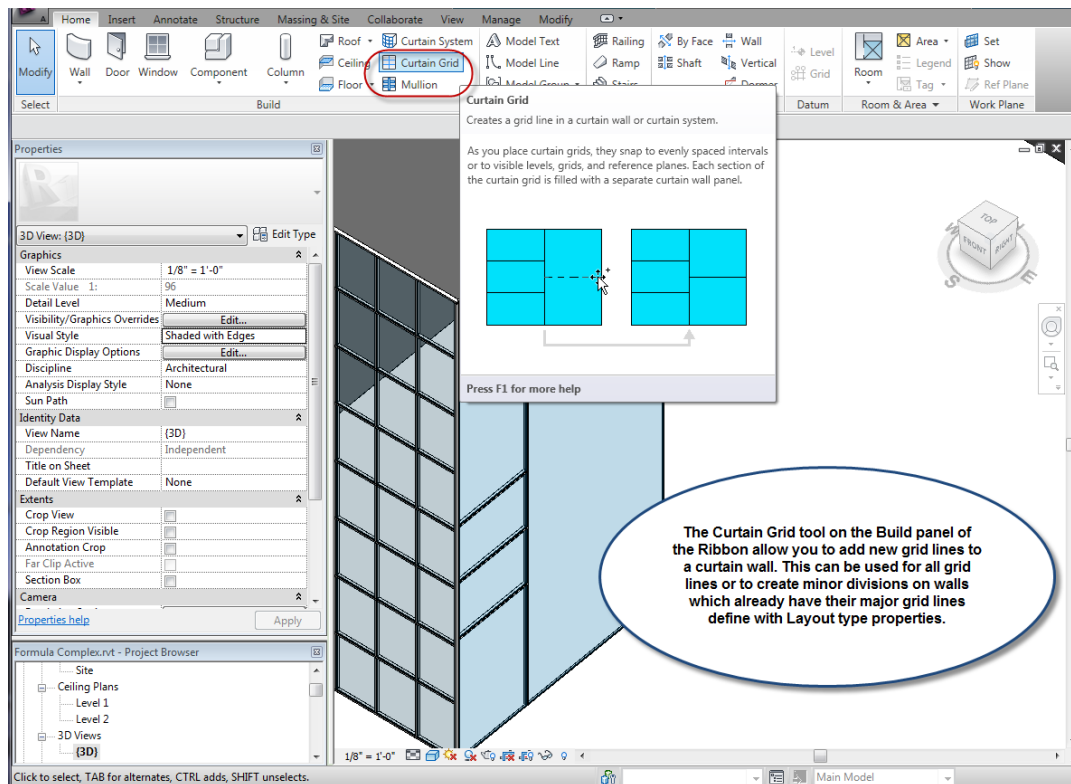
When you use a Minimum or Maximum spacing layout type, the size of the panels will increase or decrease to be as close as possible to the specified size while still creating equal sized panels.

When you use the Fixed Number layout type, the number of divisions is specified in the Instance Properties for each curtain wall element. The Fixed Number value sets the number of interior grid lines and not the number of panels for a specific direction. Therefore if you want 6 equal sized panels along the length of the wall, you would set the Number to 5.



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Curtain Grid lines may be added to Curtain walls using the Curtain Grid tool on the Build panel of the Ribbon. This method can be used to create all of the grid lines and divisions on a single panel curtain wall which has the Layout properties undefined as with the default Curtain Wall 1 type.



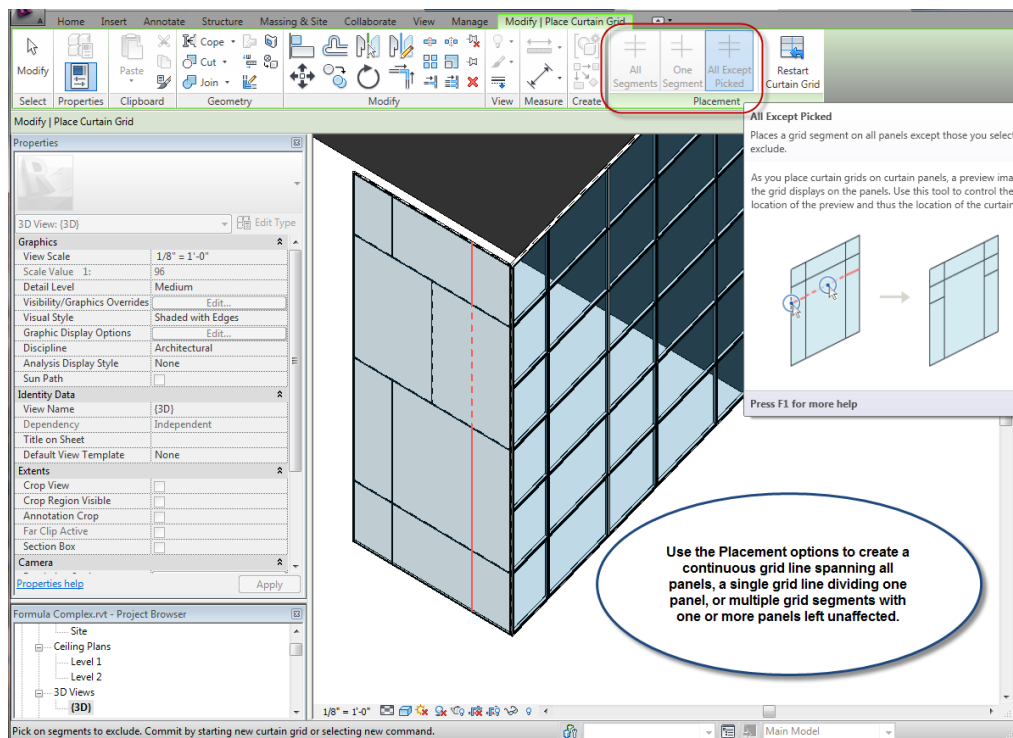
Additional grids can also be added to Curtain walls which already have been divided with the Layout type properties. This allows you to define the major divisions in both grid directions through the type properties and then add additional minor divisions manually.

Mullions will be added automatically if the Curtain Wall Type properties have an assigned mullion type for that grid direction. If the Interior Mullion type property is set to None, a grid division is created without a mullion. Mullions can then be assigned to the division line manually with the Mullion tool, also found on the Build panel of the Ribbon.

When you place Curtain grids manually, they snap to evenly spaced intervals on the curtain wall. As you drag your cursor along the wall, a tooltip will appear indicating the Midpoint of the curtain panel, the one third mark along the panel, and the two-thirds mark along the panel.

As you place curtain grids manually, the grid lines will align with levels, reference planes, and other grids. If you are adding grid lines on one curtain wall, the new lines will also align with grid lines on any adjacent curtain walls.

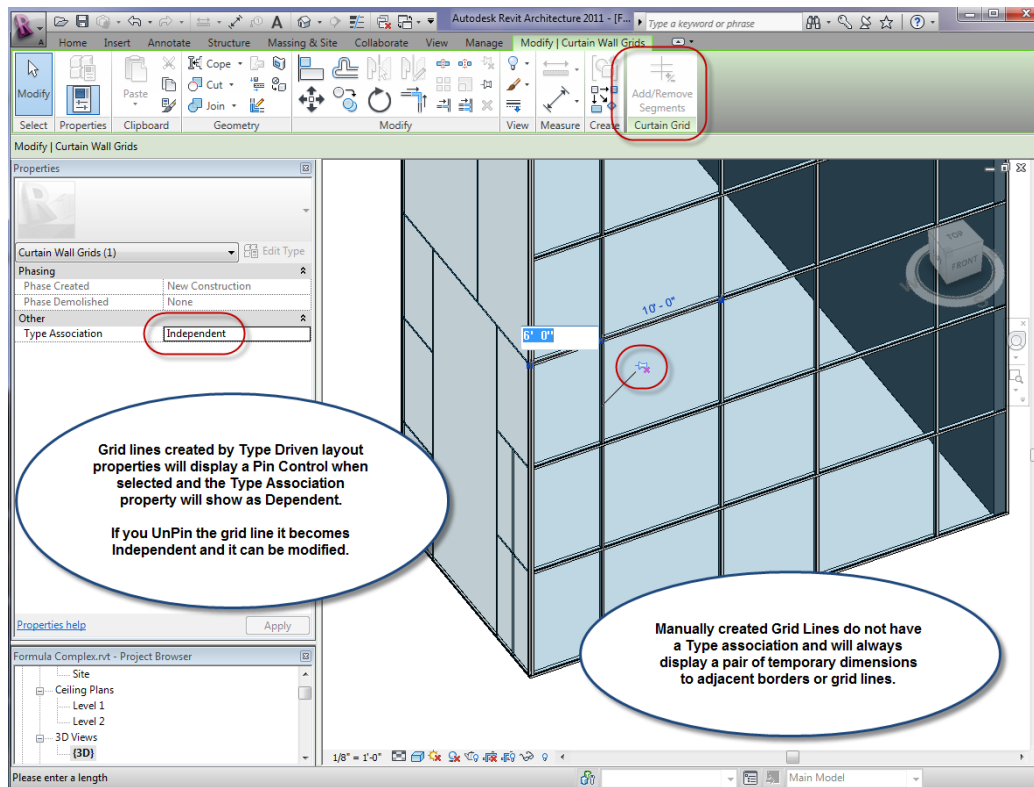
When you start the Curtain Grid tool, the Placement panel on the Ribbon will display three options. The All Segments option allows you to create a continuous grid line spanning the length or height of the curtain wall. The One Segment option will create single grid line between two adjacent division lines.



The All Except Picked option for adding grid lines will initially show a continuous red line extending along the entire length or height of the curtain wall. When you pick this line, individual segments will be removed as indicated by a dashed red line. You can continue to pick additional segments to remove from the grid line and then pick the Restart Curtain Grid tool on the Placement panel to complete the placement of the grid line segments.

If the All Except Picked method is active, you can toggle the segments between dashed and continuous by picking on them a second time. Grid lines will only be placed along panels which display the continuous red line when you choose the Restart Curtain Grid tool.

Grid lines created with Type Driven layout controls are initially locked and will display a Pin control instead of a set of dimensions. These are Dependent grid lines. If you change the type association to Independent by Unpinning the grid line, you will be able to reposition it by modifying the temporary dimensions which appear between the selected edge and the adjacent grid lines or border line.



When you use the Add Curtain Grids tool to generate grid lines, they do not have a Type association parameter and they do not display a pin control. They may be repositioned by editing their temporary dimensions or by picking and dragging the grid line to a new position.

Grid lines which have a Type association, even if it is independent, cannot be deleted. Manually created grid lines can be deleted. When you delete a grid line, any mullions on that grid line will be removed and the panels on either side will merge into a single panel.

To select a grid line which already has a mullion assignment, use Tab to cycle the selection between the mullion and the grid line. You can also continue to Tab select to the entire wall, or to any panels adjacent to the grid line.

Exercise Notes

1. In the following exercise you will learn how to work with Standard Curtain Walls, create new curtain wall types and work with curtain wall layouts and grids.
2. Start Revit and create a new Conceptual mass family with the Mass template. Switch to the Level 1 view or a Top view and create an inverted U shaped building aligned with the origin. Add dimensions to constrain the shape and create labels for Width Depth, Main Inset, and Wing Width.
3. Switch to a 3D view, select the shape and pick Create Form. Choose the solid extrusion option if you drew the shape with reference lines. Set the height to 60 feet and then convert the temporary dimension to permanent. Pick the dimension and add a label to create a Height parameter. Save the file as Curtain Mass.
4. Start a new project and save the File as Center Square. Switch to the Site level and then switch windows to the Curtain Mass family. Pick Load into Project. Choose the place on Work Plane option and add the mass to the project file.
5. Switch to the South elevation and set the elevation for level two to 12'-0". Use the level tool to create four more levels spaced 12' apart. Switch to the default 3D view. Select the Mass and choose the Generate Mass Floors tool. Select all levels and pick OK.
6. From the Model by Face panel on the Massing & Site tab choose the Floor tool. Set the type to 3" LW Concrete on 2" Metal Deck and on the options bar set the offset to 8". Pick each of the mass floor and choose Create Floor. From the Model by Face panel, choose the Roof by Face tool and set the roof type to Steel Truss – Insulation on Metal Deck – EPDM. Pick the top face of the mass and choose Create Roof.
7. Pick the Wall by Face tool float your cursor over one corner of the mass. Press Tab to select all of the faces. Select the back wall and the two long side walls and set their wall type to Exterior – Brick on Mtl Stud. Use the Align tool to align the outer faces of the roof with the inner faces of the exterior walls.

8. Select the 5 generic walls along the front of the building and in the Type Selector, from the Curtain Wall category pick Curtain Wall 1. When you Apply the change, a warning dialog will appear indicating that it can't keep elements joined. Pick Unjoin elements to continue.
9. Zoom in to one of the front bays and pick the curtain wall. This default Curtain 1 type contains no Layout information or grid lines. If you view the instance properties it may show a number of divisions but if you pick Edit Type you can confirm that the Layout type is set to None for both grid directions and all mullion assignments are set to None as well. The only type properties assigned are the Assembly Code and the Function which is set to Exterior.
10. Pick OK to close the dialog and in the Type Selector pick the Curtain Wall Exterior Glazing type. The wall now shows 7 vertical grid lines and 4 horizontal grid lines defining an array of 8x5 panels with no mullions between the panels. Zoom in to a corner of the building and you can see the horizontal division lines aligned with the floor slabs and level lines.
11. Place your cursor over one of the horizontal divisions and press Tab until a dashed line appears. Pick to select the grid line. A Pin symbol appears and the type association property shows the grid line as Dependent. Try to pick one of the temporary dimensions for the grid line and adjust its value.
12. Unpin the grid line and try adjusting the value again to see how you can reposition the grid line. Try picking and dragging the grid line to move it dynamically. Note the Type Association in the properties palette now shows as Independent. Pick the Pin symbol again to make the grid line dependent and shift back to its original position.
13. Pick any vertical grid line and on the Ribbon choose Add Remove Segments. Pick a couple of segments along the grid line and when they appear dashed, pick in an empty area. Note how the panels have been merged. Pick the Vertical Grid line again and choose Add Remove Segments again. Pick the dashed segments to make them continuous and pick Modify.
14. Pick the wall again and check its length dimension. Pick the temporary dim and change the value to 48'-0" This should extend the length of the wall so it is aligned with the outer face of the adjacent brick wall. Repeat for the other 48 foot wall on the other side of the building.

15. Open the Type Properties dialog and review the preset values. Choose Duplicate and create a new type called Exterior Glazing 5'x10'. Change the Vertical Grid spacing to 5'-0" and the Horizontal Grid spacing to 10'-0". Pick Apply and then OK to close the dialog.
16. The vertical divisions now show a narrow line of panels at one side since our 5 foot division does not divide equally into the 48 foot length. Pick the Curtain wall and set the Vertical Grid justification to Center. This will shift the divisions and create equal 4 foot panels on either end. The 10 foot height divisions will be awkward to resolve with our 12 foot floor to floor spacing. Expand the project browser list of families and open the Walls / Curtain Walls category. Right click on the Exterior Glazing 5' x10' and choose Rename. Edit 10' to read 12'.
17. Right-click on the Type name again in the Project Browser and choose Type Properties. Set the horizontal grid spacing to 12' and pick OK. Select the corresponding wall on the far side of the building and assign the 5' x12' type. Set the vertical grid justification to center.
18. Pick the main inset wall along the front of the building and in the Type Selector assign the Curtain Wall StoreFront type. Zoom in a bit so you can see the Mullions assigned on the grid lines for this type. Pick the wall and open the Type Properties. Duplicate the type and create a new type called Storefront 5'x12'. Review the type parameters to see the additional settings specifying the Curtain panel and mullion assignments. Change the Horizontal Grid spacing to 12'-0" to correspond with the floor to floor height and pick Apply. Set the Vertical Grid to Fixed Distance and leave the spacing at 5'-0". Pick Ok.
19. Pick the curtain wall and change the Vertical justification to Center. Zoom in to the ends of the panel and you can see that the end panel is very narrow. Move your cursor over the edge of the panel and press Tab until the panel highlights. Pick the panel and view its dimensions in the properties palette.
20. Select the entire wall and open the Type Properties again. Change the Vertical grid Layout type to Maximum spacing and leave the distance at 5'-0" Pick OK to close the dialog. The panels now appear equal. Tab select the end panel and check its width. Tab select the next panel over and check its width. Tab select the next and check it as well. The end panel is still a bit narrower than the rest.
21. Open the Type properties dialog again and enable the "Adjust for Mullion Size" options. Pick OK to close the dialog. Tab select the end panel and check its width. Tab select any of the other vertical panels to compare and this time they all should be perfectly equal.

22. Zoom back a bit so you can see the short curtain wall with no divisions running perpendicular between the two longer curtain walls we have already modified. From the Build Panel on the Ribbon, choose the Curtain Grid tool. From the placement Panel choose All Segments. Float your cursor over the vertical edge of the wall and choose a point at the second floor level. Drag your cursor up along the vertical edge and add a horizontal grid line at each floor level. Pick Modify to finish.
23. Use the Curtain Grid tool again with placement set to All Segments and add a grid line 3 feet below each floor level and 3 feet below the roof level. Add a vertical grid line to divide the wall equally. Change the Placement Method to All Except Picked and add another vertical grid line to divide one half into two equal sections. The Red line indicates where grid lines will be defined. Pick inside each of the 3 foot horizontal divisions and then choose the Restart Grid tool. Repeat on the opposite half and then pick Modify to finish.
24. Tab select the continuous vertical grid line and choose the Add/Remove segments tool on the Ribbon. Pick the sections of the line inside the 3 foot horizontal divisions to get the same appearance on all of the vertical divisions for this face.
25. Use the Curtain Grid tool again to add continuous grid segments 3 feet below each floor along the first wall we worked with. (Exterior Glazing 5'x12' at the front). Note how the grid lines snap to the same location as on the adjacent wall.
26. Zoom in a bit to the inside corner next to the Storefront 5'x12' wall. Add a new grid line 3 feet below each floor division again. This time it might take a second or two until the grid line appears but when it does it will include a mullion as per the type settings for interior mullion assignments along the Horizontal grid.
27. To quickly generate the same patterns of grid lines on the corresponding walls on the other side of the building, delete the originals and use the mirror tool to create reflected copies from the modified walls.

28. Switch to level 2 and use the Trim command on the inside corners where the curtain walls meet between the main horizontal inset wall and the two side walls. Zoom in to the bay section on the South East corner.
29. From the Build panel choose the Wall tool and in the Type selector, pick the Exterior Glazing 5'x12' type. Pick a start point 12 feet up from the corner of the building and then drag out a 24 foot long section of wall. A warning dialog appears to let you know that one wall is overlapping another.
30. From the Geometry panel on the Modify tab of the ribbon, pick the Cut Geometry tool. Pick the Curtain wall and then pick the main wall. Switch to a 3D view and zoom in to where you can see the embedded curtain wall.
31. Pick the wall and set its base offset to 3 feet and its unconnected height to 6'-0". Set the Vertical Grid justification to Center. Pick the wall again and choose the copy tool. Pick a base point in an open area and copy the wall 36 feet towards the back of the building. Again the warning appears about overlapping walls. Hit CTRL-Z to undo the copy.
32. Pick the Wall and choose Edit Type. Duplicate the type and create a new one called Glazing Infill 2'x2'. Set the vertical and horizontal grids to Fixed Distance at 2'-0" in both directions. Under the Construction parameters, enable the Automatically Embed option and pick OK.
33. Pick the embedded curtain wall and choose Edit Profile. Add a Start End Radius from the midpoint on each vertical edge with the radius touching the middle of the top horizontal segment to create an arch top. Delete the original horizontal line at the top and use the Trim command to clean up the overlapping vertical segments. Pick the Finish edit tool.
34. Switch to the Level two view and select the embedded curtain wall. Copy it twice towards the back of the building with 36 feet between each instance. This time the copied curtain walls will automatically embed themselves in the Host wall.
35. Switch back to a 3D view and admire your handiwork. Save and close your file. We will continue developing our curtain walls in the next class when we learn how create and work with mullions and panels.